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# *Indian Standard*

# SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES

## ART I TAPES WITH COTTON TEXTILE SUBSTRATES

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**BUREAU OF INDIAN STANDARDS**
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

**Gr 3** *August* 1963

# *Indian Standard*

# SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES

## ART I TAPES WITH COTTON TEXTILE SUBSTRATES

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# *Indian Standard*

# SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES

## PART I TAPES WITH COTTON TEXTILE SUBSTRATES

## 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 22 July 1963, after the draft finalized by the Insulating Materials Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** Insulating tapes find many applications including use in electrical equipment. The adhesive type of insulating tapes are normally of two categories, namely, the one using textile substrates and the other films made of polythene, PVC, polyester, etc. For the present, this standard confines itself to adhesive insulating tapes based on cotton textile substrates. Later, standards will be prepared for the other categories of tape.

**0.3** In preparing this standard, assistance has been derived from B.S. 1078:1954 Adhesive Insulating Tape for Electrical Purposes issued by the British Standards Institution.

**0.4** Wherever a reference to any Indian Standard appears in this specification, it shall be taken as a reference to the latest version of the standard.

**0.5** Metric system has been adopted in India and all quantities and dimensions in this standard have been given in this system.

**0.6** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS:2-1960 Rules for Rounding Off Numerical Values (*Revised*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**0.7** This standard is intended chiefly to cover the technical provisions relating to adhesive insulating tapes using cotton textile substrates, and it does not include all the necessary provisions of a contract.

## 1. SCOPE

**1.1** This standard specifies the requirements and the tests for adhesive insulating tapes using cotton textile substrates commonly used for insulation purposes in the electrical industry on low and medium voltage circuits.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Medium Voltage** — Voltage exceeding 250 V but not exceeding 650 V.

**2.2 Low Voltage** — Voltage exceeding 32 V but not exceeding 250 V.

## 3. GENERAL REQUIREMENTS

**3.1 Insulating Tape** — The insulating tape shall consist of evenly and firmly woven cotton textile fabric that has been impregnated and well and evenly coated on each side with an adhesive insulating compound and subsequently cut into rolls of narrow width. The tape shall be capable of being unwound without the end threads unravelling or getting entangled when adjacent layers of tape are separated and the compound shall not pull away from the fabric and leave bare spots during unwinding.

**3.1.1** The coating may be on one side only when agreed to between the purchaser and the supplier.

**3.1.2** A suitable separator may also be provided between layers.

**3.2 Cotton Fabric** — The cotton fabric used for the manufacture of insulating tapes shall be free from weaving defects, size or any other added matter. Particulars of cotton fabric meant for insulating fabrics are given in Table 1 for guidance.

**TABTE 1 PARTICULARS OF COTTON FABRIC MEANT FOR INSULATING TAPES**

| Count of Yarn, Approx | | Ends per dm ( or in ) | Picks per dm ( or in ) | Weight in g per $m^2$ | Breaking Strength in kg on 5·0 × 20 cm Strips | | Weave |
|---|---|---|---|---|---|---|---|
| Warp *French Count ( Universal Count ) | Weft *French Count ( Universal Count ) | | | | Warp *Min* | Weft *Min* | |
| Nf 17 ( or 30 tex ) | Nf 25 ( or 20 tex ) | 172 ( or 44 ) | 126 ( or 32 ) | 94 | 25 | 15 | Plain |
| Tolerance — | | ± 5 percent | ± 5 percent | ± 5 percent | — | — | — |

*To convert French Count to Universal Count, in tex, divide 500 by French Count.

**3.3 Adhesive Compound** — The adhesive compound shall be chemically stable and resistant to moisture and shall be free from any substance having a deleterious effect on any material to which the tape may be applied in normal use.

## 4. DIMENSIONAL REQUIREMENTS

**4.1 Length** — Rolls of tape shall be supplied in lengths of 5, 10, 25 or 50 metres unless otherwise agreed to between the purchaser and the supplier. The tape shall be wound on suitable centres.

**4.2 Width** — Tapes shall be of either 15 mm, 20 mm or 25 mm nominal width, unless otherwise agreed to between the purchaser and the supplier.

**4.3 Thickness** — Tape shall have a nominal thickness of 0·4 mm.

## 5. PHYSICAL AND CHEMICAL REQUIREMENTS

**5.1 Direction of Slitting** — The width at two points, when measured as specified in **10.4**, shall not differ by more than 2·5 mm.

**5.2 Breaking Strength** — The mean breaking strength of the tape, when tested in accordance with **10.5**, shall be not less than 7·0 kg/cm width of the tape.

**5.3 Pinholes** — The total number of pinholes in the sample length of tape, when the tape is examined as specified in **10.6**, shall not exceed the figure given below:

| *Width of Tape* | *Maximum Number of Pinholes* |
|---|---|
| mm | |
| 15 | 12 |
| 20 | 15 |
| 25 | 20 |

**5.4 Adhesion ( Resistance to Stripping )** — When tested in accordance with **10.7**, the tape shall comply with the requirements relating to adhesion, before and after accelerated ageing, specified therein.

**5.5 Freedom from Corrosive Chemicals** — When tested in accordance with **10.8**, the tape shall satisfy the requirements specified therein.

## 6. ELECTRICAL STRENGTH

**6.1** When tested in accordance with **10.9**, the tape shall be capable of withstanding a voltage of 1 000 volts rms.

## 7. AGEING AND STORAGE REQUIREMENT

**7.1** When tested in accordance with **10.10**, the tape, kept under proper storage, shall at any time within two years from the date of manufacture again meet the requirements for adhesion before accelerated ageing test.

NOTE — For the purpose of this clause, the expression 'proper storage' is intended to mean storage in the original boxes or wrappings in a cool, dark location. The tape should not be stored in close proximity to steam pipes or other sources of heat.

## 8. MARKING

**8.1** Each roll of tape shall be marked with the following particulars:

a) Name, with or without trade-mark, of the manufacturer;

b) Width and length of the tape;

c) Year and month of manufacture; and

d) Country of manufacture.

NOTE — If the rolls are supplied with single coating, it shall be specially mentioned.

**8.1.1** Each roll of tape may also be marked with the Standard Mark

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 9. PACKING

**9.1** Each roll of tape shall be properly wrapped in an air-tight moisture-proof material, such as wax paper, polythene, etc.

## 10. TESTS

**10.1 General Conditions for Tests** — Unless otherwise specified, the tests shall be carried out at prevailing atmospheric conditions. At least two layers of each sample roll of tape shall be discarded before taking the specimens for test. For test purposes, the tape shall be unwound from the roll in a smooth and even manner.

**10.1.1** The following tests shall be conducted for checking compliance with the specification:

a) Checking of Dimensions (*see* **10.3**),
b) Test for Direction of Slitting (*see* **10.4**),
c) Test for Breaking Strength (*see* **10.5**),
d) Test for Pinholes (*see* **10.6**),
e) Test for Adhesion (*see* **10.7**),
f) Test for Freedom from Corrosive Chemicals ( *see* **10.8** ),
g) Test for Electrical Strength (*see* **10.9**), and
h) Test after Ageing and Storage (*see* **10.10**).

### 10.2 Sampling

**10.2.1** A consignment of tape shall be sampled for testing in the following manner:

> In any consignment all the rolls of same length and width and manufactured under similar conditions of production may be divided into a number of groups of 5 000 rolls or less. Each such group shall constitute a lot for the purpose of sampling.
>
> Five sample rolls shall be taken at random from each lot, and each shall be marked to identify it with the lot from which it has been taken. Each of the five sample rolls shall then be tested for compliance with the specification.
>
> If each of the five rolls complies with this specification, then the lot from which they have been taken shall be deemed to comply, but if two or more fail to comply, then that lot shall be deemed not to comply.
>
> If one of the five sample rolls fails to comply, then a further set of five sample rolls, taken at random from the same lot, shall be tested. If each of these five rolls is found to comply, then that particular lot shall be deemed to comply, but if one or more of these further rolls fails to comply, then that lot shall be deemed not to comply with this specification.

### 10.3 Checking of Dimensions

**10.3.1** *Width* — The width shall be measured at five places at random in a length of not less than one metre of tape from each sample roll and in no case shall the width vary by more than one millimetre from the nominal width.

**10.3.2** *Thickness* — The thickness shall be measured with a dial type micrometer having a circular anvil of either 6·5 mm or 10 mm diameter and exerting a total force of 170 ± 15 g or 390 ± 40 g respectively to give a pressure of 0·50 ± 0·05 kg/cm$^2$. Five measurements shall be made at random in a length of not less than one metre of tape from each sample roll. The average of these five measurements shall fall within the limits of 0·40 ± 0·05 mm.

**10.4 Direction of Slitting** — A test length of 400 mm shall be taken from each sample roll and torn lengthwise from a starting cut of approximately 12·5 mm along the central axis at one end. A 25-mm length shall then be cut from each end of one of the torn pieces and the width at each end of the remaining 350 mm shall be measured. These two measurements shall not differ by more than 2·5 mm.

**10.5 Breaking Strength** — The breaking strength of the tape shall be determined on a suitable machine and the initial distance between the grips as well as the initial length of tape between them shall be adjusted to 200 mm. The test shall be made with a machine having a constant rate of traverse of 30 cm/min. Three tests shall be made on each sample roll and the mean breaking strength shall be not less than 8·0 kg/cm of width. If the tape breaks unevenly or in or at the jaws of the testing machine, the test shall be void.

**10.6 Test for Pinholes** — A three-metre length of tape from each sample roll shall be viewed over a slot in the top of an illuminated box. The box shall be approximately 200 mm wide, 200 mm high and 450 mm long internally and the slot shall be 50 mm wide and 300 mm long. The inside of the box shall be painted white and illuminated by a 25-W lamp and the slot shall be covered with clear glass, set flush with the top of the box. Means shall be provided to limit the light to the width of the tape. Ruptures of the insulating film at the extreme edges of the tape due to the slight tearing action of the knife shall not be considered as pinholes. The total number of pinholes in three metres of tape so examined shall not exceed the number specified in **5.3**.

**10.7 Adhesion ( Resistance to Stripping )**

**10.7.1** *Test Apparatus* — The test apparatus shall consist essentially of a rigid cylindrical mandrel of 25 mm diameter mounted horizontally on ball bearings; the length of the mandrel shall be sufficient to accommodate the full width of the tape and the bearings shall be such that the mandrel turns freely under a weight 30 g suspended by cotton thread wound in a single layer over the centre.

**10.7.2** *Adhesion Before Ageing* ( *For Tapes with Both Sides Coated* ) — The adhesive properties of the tape before accelerated ageing shall be determined at a temperature of 27 ± 2° C. A test length of one metre shall be taken from each sample roll. Approximately, 15 cm of the tape shall first be uniformly wound in superimposed layers on to the centre of the mandrel. A load of 1·80 kg/cm of width shall then be applied to the free end. The next 60 cm of the tape shall be wound on at a rate of 30 cm/min and the wound tape then held so loaded for three minutes. At the end of this time, a weight of 0·70 kg/cm width of tape shall be substituted for the heavier load, and the mandrel freed. Under these conditions the tape shall unwind, and after 100 mm have unwound, the length of the tape that unwinds in the next minute shall be measured and recorded. This length shall not exeed 300 mm.

**10.7.3** *Adhesion After Accelerated Ageing ( For Tapes with Both Sides Coated )* — A specimen of tape similar to that described in **10.7.2** shall be exposed to dry air at a temperature of 80 ± 1°C for a period of 120 hours. The specimen shall be supported in a suitable oven in such a way that the test length hangs freely and is not in contact with or in the too close proximity to other parts of the oven or to other tape specimens. After a rest period of not less than two hours and not more than six hours at 27 ± 2°C (during which period the aged specimens shall be protected from contact with foreign matter ), the specimen shall satisfy the requirement of the test described in **10.7.2** except that the weight applied to unwind the tape shall be 0·35 kg/cm of width instead of 0·70 kg/cm of width.

**10.7.4** *Adhesion ( For Tapes with Only One Side Coated )* — For tapes coated with the adhesive on one side only, the tests shall be conducted as detailed in **10.7.2** and **10.7.3**, but with load equal to 60 percent of that specified for tapes with both the sides coated.

**10.8 Freedom from Corrosive Chemicals*** — A test length of 100 mm shall be taken from each sample and wound centrally on a clean smooth copper rod of 6 mm diameter, and 75 mm length which shall then be enclosed in a stoppered, chemically clean glass tube and maintained at 100 ± 2°C for 16 hours. After cooling to room temperature, the rod shall be removed from the tube and examined visually. The exposed copper at the edges of the tape shall not have discoloured beyond slight tarnishing due to oxidation at the test temperature as shown by a similar copper rod without tape in a separate stoppered tube.

**10.8.1** Before the test is commenced, each copper rod shall be cleaned and polished with water and fine silicon carbide powder which will pass 106 microns IS sieve, wiped clean and dry with degreased cotton wool and finally washed with a volatile, sulphur-free solvent, such as diethyl ether, and allowed to dry. Subsequent handling of the rod shall be with clean metal forceps.

**10.9 Electrical Strength** — A suitable length of tape shall be taken from each sample roll and helically wound with 50 percent overlap for a distance of 150 mm along a clean polished cylindrical brass electrode of 25 mm diameter. The central 50 mm length of the wrapped tape shall then be covered with the metal foil held firmly in contact with the tape to form the outer electrode. The test voltage shall be alternating and shall have a nominal frequency of 40 to 60 cycles per second. It shall be approximately sine-wave form and the peak factor shall lie within the limits of $\sqrt{2} \pm 5{\cdot}0$ percent. A voltage not exceeding 100 volts rms shall be applied between electrodes and increased uniformly during one minute to 1 000 volts rms which shall then be maintained for a further one minute without failure of the tape.

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*A common source of corrosive chemical is sulphur.

**10.9.1** This test shall be applied to the sample both before and after the accelerated ageing tests.

**10.10 Ageing and Storage** — A test length of one metre shall be taken from samples kept under proper storage and subjected to the test given in **10.7.2**.

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# AMENDMENT NO. 3 FEBRUARY 1979

# TO

# IS:2448(Part I)-1963 SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES

# PART I TAPES WITH COTTON TEXTILE SUBSTRATES

## Alteration

(*Page 5, clause 5.2, line 2*) - Substitute '7.0 kg/cm width' *for* '8.0 kg/cm width'.

(ETDC 18)

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Reprography Unit, BIS, New Delhi, India

# AMENDMENT NO. 4 OCTOBER 1989
# TO
# IS 2448 ( Part 1 ) :1963 SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES
## PART 1 TAPES WITH COTTON TEXTILE SUBSTRATES

( *Page* 7, *clause* 10.3.2, *line* 1 ) — Substitute 'dead-weight dial' *for* 'dial'.

( ETDC 63 )

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Reprography Unit, BIS, New Delhi, India

# AMENDMENT NO. 5 NOVEMBER 1993
# TO
# IS 2448 ( Part 1 ) : 1963 SPECIFICATION FOR ADHESIVE INSULATING TAPES FOR ELECTRICAL PURPOSES

## PART 1 TAPES WITH COTTON TEXTILE SUBSTRATES

( *Page* 5, *clause* **4.3** ) — Add the following clause after **4.3**:

‘**4.4 Splices** — There shall not be more than one cut in a length of 10 m.’

( *Page* 9, *clause* **10.7.4** ) — Substitute the following for the existing clause:

‘**10.7.4** *Adhesion ( For Tapes with Only One Side Coated )* — For tapes coated with the adhesive on one side only, the tests shall be conducted as detailed in **10.7.2** and **10.7.3** during unwinding only and with load equal to 60 percent of that specifed for tapes with both the sides coated.’

( ET 02 )

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